

# TECH TIPS

## Diagnosing Tube/System Condition

### Diagnosing Ion-Pumped Vacuum Tube/System Condition Using the Terranova 741/751 Ion Pump Controller

#### Condition A: Hard Vacuum

1. This desired condition is indicated by low current/pressure readings. Depending on the size of the ion pump, the current should be a few microamps or less. For example, the I/P in amps per torr is approximately 10 times the pumping speed of the pump. For a 2 liter per second ion pump, I/P should be approximately 20 amps per torr. A pump current of 2 microamps ( $2 \times 10^{-6}$  amps) would indicate a pressure of  $1 \times 10^{-7}$  torr. For another example, a pressure of  $1 \times 10^{-8}$  torr would yield a pump current of 0.2 microamps ( $2 \times 10^{-7}$  amps).
2. Small ion pumps sometimes require significant time for the discharge to strike at hard vacuum. This determination should be made only after allowing several minutes to elapse after first applying the ion pump voltage.
  - a. If this condition is suspected, and the pump is accessible, lightly tap the metal body of the ion pump with a non-magnetic object, such as a pen or screw-driver handle, to encourage starting of the pump.
  - b. Another method of starting the ion pump discharge at hard vacuum conditions, is to temporarily apply a higher voltage, by the procedure described below in Condition B-1.
  - c. The starting of the discharge will be indicated by a temporary surge of current, which will then gradually decline to the expected value.
  - d. When the ion pump discharge starts, return the MAXIMUM VOLTAGE to its operating value of 4KV. This is best done without turning the High Voltage OFF!
3. Low or no current at operating voltage (4KV) can also indicate the Down to Air condition, see Condition B, below.

#### Condition B: Down to Air

1. Low or no ion pump current at operating voltage (4KV) can occur if the tube/system is down to air, that is, at high or atmospheric pressure due to a significant leak. This condition can be tested for and verified by operating the pump briefly at higher than operating voltage. Follow the steps below:
  - a. With the High Voltage OFF, press the ADJUST button twice to enter the High Voltage adjust mode (the red LED marked "Maximum Voltage" will be illuminated.)
  - b. Press the RAISE button until the display shows 7.50 (7500 volts).
  - c. Press the ADJUST button four more times to return to the OPERATE mode.
  - d. Press and hold the High Voltage On/Off button until the display begins to show the voltage and current.



2. As the voltage rises toward 7.5KV (7500 volts), the current pressure display will fluctuate and you should hear a "sizzling" or "tickling" sound from the ion pump due to high voltage breakdown inside the pump.
3. DO NOT leave the High Voltage on in this condition for more than a few seconds at a time, because damage could occur to the internal insulating surfaces of the ion pump.

#### Condition C: Poor Vacuum

If the operating current is steady at a higher than expected value, for example, more than 10 microamps ( $1 \times 10^{-5}$  amps) for a two liter per second ion pump, the vacuum in the tube/system is poor. Further tube/system diagnosis, leak checking and repair should be undertaken.

#### Condition D: Pump Leakage Current

If the ion pump current is a steady or fluctuating around a few microamps, and it is believed that the tube/system is under hard vacuum, there may be leakage current in the ion pump. The following steps can be taken to resolve this condition.

1. Insulator External Surface Contamination: After turning the High Voltage OFF, remove the High Voltage Connector from the ion pump. Using a lint-free cloth or paper wipe and some solvent such as alcohol, gently clean the insulator surface of the High Voltage Feedthrough. When the surface is clean and dry, re-attach the High Voltage Connector and resume operation.
2. Field Emission Leakage Current: Follow the steps outlined in Section III-F above to diagnose and fix this condition.
3. If neither of these steps reduces the current, it is most likely truly due to ion current related to slightly elevated pressure in the tube/system.

#### Additional Information

If you need additional information, please call Duniway Stockroom at 1-800-446-8811 or go to our web-site, [www.duniway.com](http://www.duniway.com). On our web-site, under "DOCUMENTS", you will find on-line versions of the Terranova 741/751 Manuals, plus more information on operating ion pumps.